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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/552,582	10/12/2005	Tomohiro Iwasaki	2005_1606A	2542

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EXAMINER	
SUMMONS, BARBARA	

ART UNIT	PAPER NUMBER
2817	

MAIL DATE	DELIVERY MODE
07/31/2007	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/552,582	IWASAKI ET AL.	
	Examiner	Art Unit	
	Barbara Summons	2817	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☐ Responsive to communication(s) filed on _____.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) 1-12 is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) 1-12 is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on 12 October 2005 (with repl.sheet) is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☒ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date 10/12/05.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Claim Rejections - 35 USC § 102

1. The following is a quotation of the appropriate paragraphs of 35 U.S.C. § 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

2. Claims 1, 8, 9 and 12 are rejected under 35 U.S.C. § 102(b) as being anticipated by Weber U.S. 5,864,261 (cited by Applicants).

Fig. 1 of Weber discloses a thin film bulk acoustic resonator (FBAR) comprising: a substrate 20; an acoustic mirror layer 40 provided on the substrate, including a plurality of impedance layers (layer pairs 42-45) alternately having a high acoustic impedance and a low acoustic impedance (see e.g. col. 7, lines 3-40); and a piezoelectric thin film vibrator provided on the acoustic mirror layer 40, including a lower electrode 37 (see e.g. col. 4, lines 57-61), a piezoelectric thin film 35 and an upper electrode 36, wherein the sum of a thickness of the lower electrode and the upper electrode is 0.3 + 0.2 = 0.5 microns (see col. 7, lines 51-58) which is 35.71% of the total thickness of the vibrator which is 0.3 + 0.2 + 0.9 = 1.4 microns, and the thickness of the lower electrode is 0.3 microns which is larger than the thickness of the upper electrode.

Regarding claims 8 and 9, Weber discloses that any or all of the acoustic mirror high and low acoustic impedance layers may have a thickness different from the one quarter wavelength of the vibrator operating frequency shown (see e.g. col. 10, lines 28-43). Regarding claim 12, Fig. 5 shows the FBAR in a filter i.e. a communication device.

Claim Rejections - 35 USC § 103

3. The following is a quotation of 35 U.S.C. § 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

4. Claims 2-7, 10 and 11 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Weber U.S. 5,864,261 (cited by Applicants) taken alone.

Weber discloses the invention as discussed above, and also discloses the uppermost and all of the high and low acoustic impedance layers being one quarter wavelength thick (see col. 7, lines 36-40), or being different from such a thickness (see col. 10, lines 28-48), wherein whether the layers are more or less than one quarter wavelength in thickness would have been a mere design choice based on the intended use (i.e. reflection vs. impedance matching to the substrate, ibid. or temperature compensation, col. 11, lines 55-62) and the materials chosen for the high and low acoustic impedance layers (ibid.).

However, Weber discloses the lower electrode being a low acoustic impedance layer (see col. 5, lines 25-32) such that there is not an "uppermost one of the low acoustic impedance layers which contacts the lower electrode" (emphasis added) as required by the claims (see each of claims 2, 4, and 6, lines 5-6 thereof), and Weber does not explicitly disclose a ladder filter or a duplexer.

The Examiner Takes Official Notice that it would have been extremely well known in the FBAR art to provide acoustic mirrors with the top layer being a low acoustic impedance layer in contact with a high acoustic impedance electrode layer, as is also evidenced by other art of record (see e.g. Ella et al applied below), and that using such resonators to form ladder filters and duplexers, which are communication devices, would have been extremely well known intended uses of FBARs as also evidenced by other art of record.

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have modified the FBAR of Weber (Fig. 1) such that the uppermost low acoustic impedance layer would have been in contact with the aluminum lower electrode, by for example substituting silicon dioxide for the uppermost low acoustic impedance layer paired with the aluminum electrode layer 37 in the layer pair 42, because such an obvious modification would have been merely the substitution of extremely well known art recognized alternative acoustic mirror layer materials, as would have been known by one of ordinary skill in the art, and because Weber explicitly suggests using different material constituents in each of the mirror layer pairs (col. 10, lines 28-48) and differing their thicknesses from the standard one quarter wavelength,

which one of ordinary skill in the art would have known included values of both more and/or less than one quarter wavelength dependent upon the specific chosen materials and intended use of the mirror layers (ibid. and col. 11, lines 55-62), and wherein ladder filters and duplexers in communication devices would have been merely extremely well known intended uses of FBARs, and because Weber also suggests its resonator be used in a filter (see e.g. col. 8, lines 40-46) wherein a ladder filter would have been merely an art recognized alternative filter topology.

5. Claims 1-12 are rejected under 35 U.S.C. §103(a) as being unpatentable over Ella et al. U.S. 6,518,860 in view of Tikka et al. U.S. 6,407,649.

Regarding claims 1, 10 and 12, Fig. 1 of Ella (see also Fig. 1 of the associated published application 2002/0089395 which published larger and easier to see) discloses a communication device including ladder filters for the GMS filter and the CDMA filter (see also Fig. 3) each including a thin film resonator comprising: a substrate 10; an acoustic mirror including alternating low acoustic impedance silicon dioxide layers and high acoustic impedance tungsten layers; and an thin film resonator, e.g. resonator 12 of the GMS filter, is formed on the acoustic mirror, since each of the resonators have layers of the same thicknesses except for the piezoelectric layers and tuning layers (see col. 4, lines 10-23) the resonator 12 is formed of a lower electrode of Al with a thickness of 300 nm, a piezoelectric layer of ZnO with a thickness of 1032 nm and an upper electrode of Al with a thickness of 405 nm including the shunt tuning layer, wherein the sum thickness of the upper and lower electrodes is 705nm and is 40.59% of the total

thickness of the resonator which is 1737nm [Note that the CDMA filter also has a resonator 14 with a sum total of the thickness of the electrodes being 685nm which is 42.15% of the total thickness 1625nm of the resonator]. Regarding claims 2-9, Ella discloses various thicknesses of the mirror layers and that the mirror layers are optimized for an average of all of the center frequencies of the filters on the substrate or optimized for the center frequency of the filter requiring the widest bandwidth, in this case the GMS filter (see col. 7, lines 3-26). Since in general, the thickness of the resonator is one half wavelength for the fundamental mode of vibration (series resonator 13 is 1632 nm thick) then a quarter wavelength is approximately 816 nm such that all of the layers have a thickness smaller than a quarter wavelength.

However, it is the thickness of the upper layer that is larger than the lower layer, not vice versa, as required by the independent claims. Ella also does not disclose a duplexer per se, and does not specifically disclose quarter wavelength or larger acoustic mirror layers. It should be noted that quarter wavelength mirror layers would have been the standard in the art, and whether quarter wavelength layers or layers with thicknesses larger than a quarter wavelength are used would have been dependent upon which filter the layers are optimized for and what the frequencies of the various filters being formed on the same substrate are, these being design considerations suggested by Ella (see co. 7, lines 3-26) which one of ordinary skill could easily apply to filters in other systems besides those illustrated.

Tikka et al. teaches that in such thin film resonators it would have been well known when using a metal Al tuning layer for shunt resonator (or transmitter filter tuning

in a duplexer) that it can alternatively be placed on the lower electrode rather than the upper electrode (see e.g. the Tx tuning layer in series resonator 72a in Fig. 7 and see col. 4, lines 40-45 and col. 5, line 62 to col. 6, line 2) such that the thickness of the lower electrode is larger than that of the upper electrode. Tikka et al. also discloses that it would have been obvious to form the filters of a duplexer on a same substrate.

Therefore, it would have been obvious to one of ordinary skill in the art a the time the invention was made to have modified the resonator/filter/communication device of Ella (Fig. 1) such that it would have included a duplexer and the shunt tuning layer of the resonator 12 would have been placed on the lower electrode making the lower 405nm electrode thicker than the upper 300nm electrode and forming the mirror layers equal to or larger than one quarter wavelength, because such an obvious modification as moving the tuning layer would have been the mere rearrangement parts and placement of tuning layers in art recognized alternative locations as explicitly suggested by Tikka (ibid.), and wherein duplexers would have been merely an extremely well known communication system in the monolithic thin film resonator filter art, as evidenced by Tikka et al. such that forming GMS or CDMA filters for both transmitting and receiving would have been obvious, and wherein the thickness of the mirror layers would have been dependent upon which filter the mirror layers would have been optimized for and other design considerations such as what specific frequency systems are the intended use of the device and bandwidth considerations as explicitly suggested by Ella (see col. 7, lines 3-26). That is, if the intended use does not include GMS then the mirror layers may be optimized for the CDMA band or another band.

Conclusion

6. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

Ella U.S. 2002/0089395 is the published U.S. application of U.S. 6,518,860 applied above and is cited because Fig. 1 is larger and easier to see in this document.

Ylilammi et al. U.S. 5,873,154 discloses a thin film resonator on an acoustic mirror with a lower electrode that is thicker than the upper electrode (see Figs. 3 and 4).

Kawakubo et al. U.S. 6,809,604 provides evidence that the total thickness of such thin film resonators is generally one half wavelength of the fundamental operating frequency (see col. 1, lines 26-34).

7. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Barbara Summons whose telephone number is (571) 272-1771. The examiner can normally be reached on M-Th, M-Fr.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Bob Pascal can be reached on (571) 271-1769. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

bs
July 25, 2007

Barbara Summons

BARBARA SUMMONS
PRIMARY EXAMINER

Approved: bn Emtiy 7/24/07 BS

Replacement Sheet 10/552582

FIG. 28 - PRIOR ART

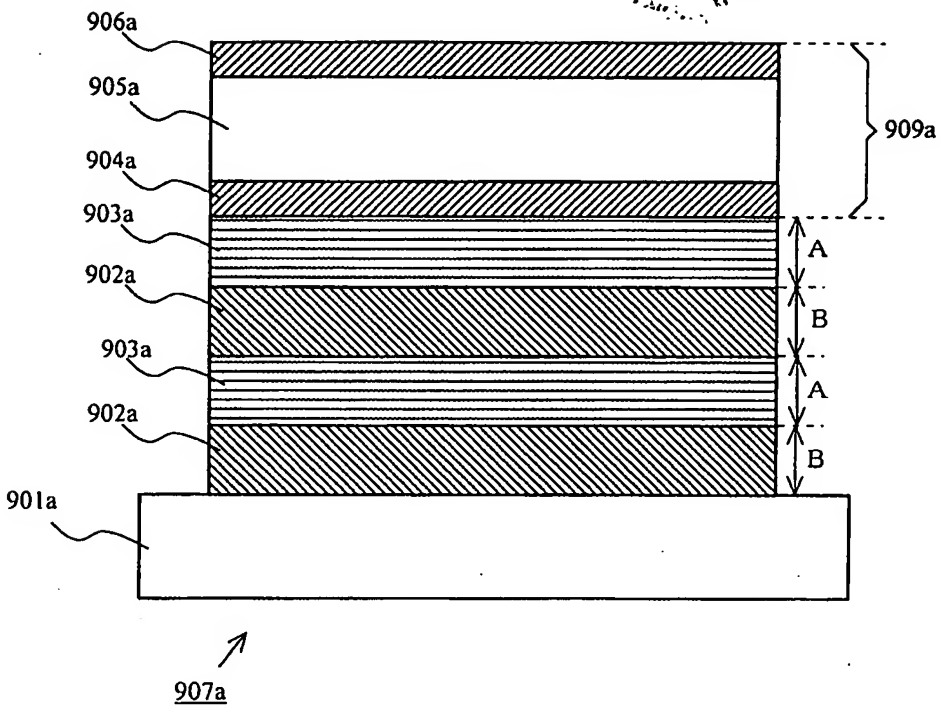

FIG. 29 - PRIOR ART